ATTACHMENT II

ADDITIONAL SUPPORTING DOCUMENTS AND INFORMATION

The following additional supporting documents and information are available for public comment during the supplemental public comment period in the LEV II rulemaking.

A. References Pertaining to the Exhaust Emissions Component of the LEV II Proposal

The following list of references on technological feasibility was unintentionally omitted from the Staff Report.

1. Albu S., Wong J., "Technologies for Meeting Ultra-Low-Emission Levels," SAE Paper 94C012.
2. Becker E., Watson R., "Future Trends in Automotive Emission Control," SAE Paper 980413.
3. Yamamoto M., Tanaka H., "Influence of Support Materials on Durability of Palladium in Three-Way Catalyst," SAE Paper 980664.
4. Song Y., Jang J., Yeo G., "Development of Single Coated Pd/Rh Three Way Catalyst for CCC Application," SAE Paper 980666.
5. Cuif J., Deutsch S., Marczi M., et. al., "High Temperature Stability of Ceria-Zirconia Supported PD Model Catalysts," SAE Paper 98068.
6. Gulati S., Williamson B., Nunan J., Anderson K., Best J., "Fatigue and Performance Data for Advanced Thin Wall Ceramic Catalysts," SAE Paper 980670.
7. Carter C., Menacherry P., Pfefferle W., Muench G., Roychourdhury S., "Laboratory Evaluation of Ultra-short Metal Monolith Catalyst," SAE Paper 980672.
8. Takahashi H., Ishizuka Y., Tomita M., Nishizawa K., "Engine-Out and Tail-Pipe Emission Reduction Technologies of V-6 LEVs," SAE Paper 980674.
9. Gulati S., Jones L., Brady M., Baker R., et. al., "Advanced Three-Way Converter System for High Temperature Exhaust Aftertreatment," SAE Paper 970265.
10. Roychoudhury S., Muench G., Bianchi J., Pfefferle W., Gonzales F., "Development and Performance of Microlith Light-Off Preconverters for LEV/ULEV," SAE Paper 971023.
11. Punke A., Dahle U., Tauster S., Rabinowitz H., Yamada T., "Trimetallic Three-Way Catalysts," SAE Paper 950255.
12. Lindner D., van Yperen R., Lox E., Ostgathe K., Kreuzer T., "Reduction of Exhaust Gas Emissions by Using Pd-based Three-way Catalysts," SAE Paper 960802.
13. Kishi N., Hashimoto H., Fujimori K., Ishii K., Komatsuda T., "Development of the Ultra Low Heat Capacity and Highly Insulating (ULOC) Exhaust Manifold for ULEV," SAE Paper 980937.
14. California Air Resources Board, "Low-Emission Vehicle and Zero-Emission Vehicle Program Review," Staff Report, November 1996.

These documents are available for inspection during normal business hours at the Air Resources Board's Public Information Office at 9528 Telstar Avenue, El Monte, CA 91731, (626) 575-6726.

B. Cost and Economic Impact Estimates.

Section VI of the Staff Report contained staff's estimate that, when fully implemented, the proposed amendments would increase the retail cost of a vehicle by a range of $68 to $276 (after accounting for the CAP 2000 savings), with an average increased cost of $187. After full phase-in, the estimated annual economic cost was about $285 million. These figures, which were based on a preliminary analysis, overestimated the economic costs. The staff's updated estimates presented at the November 5, 1998 hearing are a per-vehicle cost range of about $68 to $206, and an average per-vehicle cost of about $107. Estimated annual economic costs are $170 million.

The overall impacts from the proposal result from three elements: the LEV II exhaust emissions component, the LEV II evaporative emissions component, and CAP 2000. As indicated in the Staff Report, the cost of the evaporative emissions element is estimated to be $25 per vehicle, and the CAP 2000 changes are expected to result in a cost savings of about $28 per vehicle. Thus the overall per-vehicle costs are expected to be approximately $3 per vehicle less than the estimated costs from the LEV II exhaust emissions element.

Pages II-54 to II-60 of the Staff Report and Tables II-29 to II-38 set forth the cost analysis for the LEV II exhaust element. These costs are summarized on page II-54 in the following table, which shows the estimated incremental retail costs of ULEV II and SULEV vehicles compared to a ULEV I vehicle in different weight classifications:

Category	ULEV II (in $)	SULEV (in $)
PC	71	131
LDT 1	46	105
LDT 2	184	279
MDV 2	208	-
MDV 3	209	-
MDV 4	134	-

Although most 2003 model year LEV I light-duty vehicles are expected to be LEVs rather than ULEVs, the ULEV I standard is an appropriate baseline because most of the ULEV II incremental costs are attributable to additional oxides of nitrogen (NOx) controls and LEV 1 LEVs and ULEVs have the same NOx standard.

Estimated range of per-vehicle costs. The $276 high end of the range of per vehicle costs in the Staff Report was derived from the estimated incremental cost of $279 for a LDT2 (heavier light-duty truck) meeting the SULEV standard rather than the ULEV I standard. But the fully phased-in fleet average NMOG requirement for LDT2s, which drives the overall level of stringency for a manufacturer's LDT2 fleet, allows the manufacturer to comply with almost all vehicles meeting the ULEV II standard and no vehicles subject to the SULEV standard. Therefore the estimated incremental per vehicle cost of $209 for the MDV 3 class to meet the ULEV II exhaust emission standard should be used in identifying the high end of the per vehicle cost range, resulting in an estimated cost of $206 per vehicle after factoring in the evaporative emissions element and the CAP 2000 savings. The originally estimated $68 per vehicle cost for the low end of the range of costs was appropriately derived from the estimated cost for passenger cars meeting the ULEV II standard.

Estimated average per-vehicle costs. As the LEV II requirements are phased-in between the 2004 and 2010 model years, ULEV II is expected to become the dominant emissions category for light and medium-duty vehicles. Accordingly, the average per vehicle costs for LEV II are appropriately derived from the incremental cost of moving from the ULEV I to the ULEV II standard. The estimated per vehicle costs for each weight category are combined based on the percentage each category represents in current sales: 54% PC, 9% LDT1, 27% LDT2, 5% MDV2 and 5% MDV3 (the 8501 lbs. GVWR and over "MDV 4" category was not included because it represents a very small percentage of vehicles). The resulting average cost is $112.65, which staff rounded to $110 and adjusted to $107 per vehicle to reflect the evaporative emissions element and CAP 2000.

Estimated annual economic impacts on manufacturers. The annual economic impact of the fully implemented LEV II program is calculated by multiplying the estimated per vehicle cost of $107 by the number of affected vehicles. Staff is using 1998 model-year data, showing sales of approximately 1.7 million vehicles in the affected categories. Since 10 percent of the approximately 1.2 million PCs and LDT1s are already required to be ZEVs in 2003 and subsequent model years, staff estimated annual sales of LEV II vehicles at 1.6 million. The resulting estimated annual cost is $171.2 million, rounded to $170 million per year.

C. Cost-Effectiveness for Other Air Pollution Control Measures.

The table and chart on the next page show the estimated cost-effectiveness of other ARB control measures designed to reduce emissions of volatile organic compounds (VOCs) and NOx.